REMARKS

Claims 1-5 are presently pending in the application. Reconsideration and allowance of all claims are respectfully requested in view of the following remarks.

The Examiner has objected to Figure 6, stating that it should be designated by the legend --Prior Art--. The Examiner is respectfully requested to acknowledge receipt of one (1) sheet of Proposed Drawing Corrections, which amends FIG. 6 to add the legend --Prior Art--. Under the assumption that the Examiner will approve the Proposed Drawing Corrections, corrected formal drawings are attached.

The Examiner has objected to the disclosure due to informalities. The disclosure has been amended to correct for any informalities noted by the Examiner, and thoroughly reviewed to correct for any further informalities.

The Examiner has rejected Claims 1 and 4 under 35 U.S.C. 112, second paragraph, as being indefinite. The claims have been amended to assure that they are definite.

The Examiner has rejected Claims 1-2 and 4-5 under 35 U.S.C. 103 as being unpatentable over Glenn et al. (USP 6,342,406, hereafter Glenn et al '406) in view of Glenn et al. (USP 6,266,197, hereafter Glenn et al. '197). Claim 3 was rejected under 35 U.S.C. 103 as being unpatentable over Glenn et al. '406 and Glenn et al. '197 and further in view of Ogawa et al. For the following reasons, the prior art rejections are respectfully traversed.

The Applicant herewith submits a Declaration under 37 C.F.R. 1.131, which establishes completion of the present invention in Japan, a WTO country, prior to the effective date of the Glenn et al. '406 reference. The Applicant relies upon Japanese Patent Application No. P2000-012401, filed January 21, 2000, which antedates the effective date of November 15, 2000 of Glenn et al. '406. In support thereof, the Applicant herewith a copy of Japanese Patent Application No. P2000-012401 and an English translation of the document.

Accordingly, Glenn et al. '406 is removed as a prior art reference in this case, and since the prior art rejections all include Glenn et al. '406 in combination, all the prior art rejections against Claims 1-5 must fail.

Thus, the present application should be in condition for allowance, and such action is hereby solicited.

If the Examiner believes that there is any issue which could be resolved by a telephone or personal interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number listed below.

Applicants hereby petition for any extension of time which may be required to maintain the pendency of this case, and any required fee for such an extension is to be charged to Deposit Account No. 19-3140.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Page 2, the first full paragraph was amended as follows:

The thickness of the conventional module 51 is equal to the total thickness of the image pickup device 52, the mounting board 53, and the lens unit 54 which constitute the camera module 51. Therefore, in order to manufacture a low-profile camera module 51 (i.e., a camera module having a small thickness), it is necessary to reduce the thickness of each constituent part.

Page 2, the second full paragraph was amended as follows:

[However, under] Under the present condition, the upper limit [level] of reducing the thickness of each of the image pickup device 52, the mounting board 53 and the lens unit 54 is about to be reached. [Accordingly, it is extremely difficult at present to further reduce the thickness of the camera module 51.]

Page 2, the third paragraph, continuing to page 3, was amended as follows:

Therefore, according to an aspect of the present invention, there is provided an image pickup device including: a light-transmissible board having a wiring pattern formed on one surface thereof and containing an optical filter; and an image pickup element having a photodetecting portion formed on one surface thereof, the image pickup element being mounted on the one surface of the light-transmissible board in a flip-chip style so that the photodetecting portion of the image pickup element is opposed to an area where the wiring pattern is unformed.

Page 3, the second full paragraph was amended as follows:

According to another aspect of the [presents] present invention, there is provided a camera module which includes: a light-transmissible board having a wiring pattern formed on one surface thereof and containing an optical filter; an image pickup element having a photodetecting portion formed on one surface thereof, the image pickup element being mounted on the one surface of the light-transmissible board in a flip-chip style so that the photodetecting portion of the image pickup element is opposite an area where no circuit pattern is formed; and a lens unit mounted on the other surface of the light-transmissible board so as to be located above the photodetecting portion of the image pickup element.

Page 4, the first full paragraph was amended as follows:

In the camera module thus constructed, and the camera system using the camera module, the image pickup element is mounted in the flip-chip style on the surface of the light-transmissible board on which the wiring pattern is formed, and the lens unit is mounted on the opposite surface of the light-transmissible board[,]. [whereby] Thus, the thickness of the image pickup device can be reduced to be less than that of the conventional module structure by the amount corresponding to the thickness of the package, to hermetically seal the image pickup element[,]. [and also] Further, the constituent parts (the light-transmissible board, the image pickup element and the lens unit) constituting the image pickup device can be arranged densely in the thickness direction of the module. [Further, the light-transmissible board is provided with the optical filtering function, whereby it is unnecessary to install the optical filter board in the lens unit.]

Page 5, the sixth paragraph was amended as follows:

Fig. 1 is a side view showing the construction of a camera system according to the present invention. The camera system shown in Fig. 1 comprises a camera module 2 and a system module 3. The camera module 2 and the system module 3 are [electrically] connected [to each other] through a connector 4.

Page 5, the seventh paragraph, continuing to page 6, was amended as follows:

Various electronic parts 6A to 6D and system ICs 7A to 7C, as well as the connector 4, are mounted on both [the] sides of a wiring board 5 of the system module 3. The system ICs 7A to 7C are used to constitute a driving circuit for driving the camera module 2, an image processing circuit for performing various image processing (for example, image compression processing, etc.) on image signals obtained by the camera module 2, etc. On the wiring board 5 is mounted a USB (Universal-Serial-Bus) connector 8 for connecting the camera system 1 containing the system module 3 to an information terminal such as a personal computer or the like.

Page 7, the third full paragraph, continuing to page 8, was amended as follows:

The image pickup element 11 is mounted on the lower surface of the light-transmissible board 10 through bumps 16 while it is kept as a bare chip (this mounting state will be referred to as "flip-chip-mounted"), whereby the electrode portion (not shown) of the image pickup element 11 and the wiring pattern of the light-transmissible board 10 are electrically connected to each other through the bumps 16. Under this mounting state, the image pickup element 11 is flip-chip-mounted on the lower surface of the light-transmissible board 10. [so that] Thus, the photodetecting portion 15 is opposite an area on which no wiring pattern 13 is formed (area where no circuit pattern is formed) so that light incident to the photodetecting portion 15 of the image pickup element 11 is not intercepted by the wiring pattern 13.

Page 9, the first full paragraph was amended as follows:

The holder 18 of the constituent parts of the lens unit 12 is designed in a cylindrical structure, and the mirror barrel 19 is fitted to the inner peripheral side of the holder 18. The inner peripheral surface of the holder 18 and the outer peripheral surface of the mirror barrel 19 are threaded as occasion demands. If the mirror barrel 19 [thus threaded] is threaded into the holder 18 [thus threaded], both the mirror barrel 19 and the holder 18 are relatively moved in the central axis direction (optical axis direction) to perform a focusing operation. The tip portion of the mirror barrel 19 is bent substantially perpendicularly toward the

center axis, thereby forming a diaphragm portion 19A for regulating the incident light integrally with the mirror barrel 19.

Page 9, the third full paragraph, continuing to page 10, was amended as follows:

In the camera module 2 thus constructed, the light incident through the diaphragm portion 19A of the lens unit 12 is focused to the photodetecting portion 15 of the image pickup element 11, due to the refractive action of the lens 20. During this process, light components of the infrared region (infrared rays) are removed from the light transmitted through the lens 20 by the infrared ray cutting function of the light-transmissible board 10 when passing through the light-transmissible board 10. The [removable] removal of the light components of the infrared region can prevent both erroneous coloring and occurrence of smear when a high-brightness subject is subjected to an image pickup operation. Further, the light incident through the light-transmissible board 10 is detected by the photodetecting portion 15 of the image pickup element 11 and photoelectrically converted to image signals. The image signals thus obtained are transmitted to the system module 3 (see Fig. 1) through the wiring pattern 13 of the light-transmissible board 10.

Page 10, the third full paragraph, continuing to page 11, was amended as follows:

Infrared ray cut glass articles put on the market by optical part makers, for example, HOYA:C5000, Asahi Glass: PF-606M3, Toshiba Glass: CF-50 or the like, may be used for the light-transmissible board 10. These infrared rays cut glass articles are infrared rays absorption type filters[,] and have a sufficient infrared [rays] ray cutting function in the range from 700 to 1200nm.

Page 11, the first full paragraph was amended as follows:

The bumps 16 are formed as follows. As shown in Fig. 5A, a ball is formed at the tip of a metal wire 23 drawn out from the tip of a capillary 22 and press-fitted to an electrode portion (aluminum pad) 11A of the image pickup element 11. Thereafter, as shown in Fig. 5B, the metal wire 23 is not drawn out

from the capillary 22 and the metal wire 23 is cut at the ball side. This bump forming method is called [as] a "ball bump method" or "stud bump method". In addition to this method, a bump forming method using an electroless plating method, a transfer bump method, or a bump forming method using [a] soldering [technique] may be used.

Page 11, the second full paragraph, continuing to page 12, was amended as follows:

Subsequently, the image pickup element 11 is mounted on the lower surface of the light-transmissible board 10 via the bumps 16 (flip-chip mount) as shown in Fig. 4B. During this mounting step, the light-transmissible board 10 is put on a table (not shown), and the image pickup element 11 is fixed by a bonding tool (not shown). Thereafter, the bumps 16 formed on the electrode portions of the image pickup element 11 are electrically and mechanically bonded to the wiring pattern 13 of the light-transmission board 10 by ultrasonic bonding, while the light-transmission board 10 on the table and the image pickup element 11 are positioned by the bonding tool to each other.

Page 12, the first full paragraph was amended as follows:

The positioning of the light-transmissible board 10 and the image pickup element 11 is carried out by matching 1) the relative position between the element mounting area 14 of the light-transmissible board 10 and the photodetecting portion 15 of the image pickup element 11, and 2) the relative position between the wiring pattern 13 of the light-transmissible board 10 and the corresponding electrode portions of the image pickup element 11, in the direction (generally, horizontal direction) perpendicular to the direction of pressure of the bonding tool, respectively. The ultrasonic bonding is carried out under the following conditions: frequency of 50KHz; tool temperature of 100(C; table temperature of 100(C; bonding time of 0.5 second; tool pressure of 100g per bump; and amplitude of 2.5(m.

Page 12, the second full paragraph, continuing to page 13, was amended as follows:

Here, the heating temperature in the ultrasonic bonding step is preferably set to 170°C or less, so that when a microlens is formed on the principal surface of the image pickup element 11, there is no risk that the microlens is thermally damaged. Any bonding method other than the above ultrasonic bonding method may be used as the bonding method in the step of mounting the image pickup element 11 on the light-transmissible board 10, if it can implement the low-temperature bonding treatment satisfying the above temperature condition (170°C or less). Specifically, a bonding method using silver paste, indium or anisotropic conductive material may be used.

Page 13, the second full paragraph, continuing to page 14, was amended as follows:

Subsequently, as shown in Fig. 4D, a lens unit 12 which has been fabricated in advance is mounted on the upper surface of the light-transmission board 10. In this mounting step, for example, adhesive agent of an epoxy group (not shown) is coated on the end face of the holder 18 of the lens unit 12 or the upper surface of the light-transmissible board 10 corresponding to the mounting position of the lens unit 12. Thereafter, the lens unit 12 is pressed against the upper surface of the light-transmissible board 10 under the state that the lens unit 12 and the image pickup element 11 are positioned to each other, thereby fixing the lens unit 12 to the light-transmissible board 10 through the adhesive agent.

Page 15, the first full paragraph was amended as follows:

Accordingly, the ultra-thin type camera module can be achieved. Further, even the image pickup device [including] which includes the combination of the light-transmissible board 10 and the image pickup element 11 can be designed to be thinner than the conventional image pickup device 52 (see Fig. 6). Still further, the camera system 1 using the camera module 2 can be installed in an information terminal by using a smaller securing space because the thickness of the camera module 2 is reduced.

IN THE CLAIMS:

The claims were amended as follows:

1. (Amended) An image pickup device including:

a light-transmissible board having a wiring pattern formed on one surface thereof and containing an optical filter; and

an image pickup element having a photodetecting portion formed on the same surface thereof, said image pickup element being mounted in flip-chip style on the one surface of said light-transmissible board so that the photodecting portion of the image pickup element is [opposite to an area where there is no wiring-pattern] opposed to an area where the wiring pattern is not formed.

3. (Amended) The image pickup device as claimed in claim 1, wherein [the] a peripheral edge portion of said image pickup element is sealed with resin.

4. (Amended) A camera module including:

a light-transmissible board having a wiring pattern formed on one surface thereof and containing an optical filter;

an image pickup element having a photodetecting portion formed on the same surface thereof; and

a lens unit mounted on the other surface of said light-transmissible board so as to be located above said photodetecting portion of said image pickup element, said image pickup element being mounted in flip-chip style on the one surface of said light-transmissible board so that the photodetecting portion of the image pickup element is [opposite to an area where there is no wiring-pattern] opposed to an area where the wiring pattern is not formed.

IN THE ABSTRACT OF THE DISCLOSURE:

The Abstract of the Disclosure was amended as follows:

A camera module including a light-transmissible board [10] having an infrared rays cutting function on one surface of which a wiring pattern [13] is formed, an image pickup element [11] having a

photodetecting portion [15] which is flip-chip-mounted on the same surface of the light-transmissible board [10] while the photodetecting portion [15] is opposite to an area where there is no wiring-pattern [13], and a lens unit [12] which is mounted on the other surface of the light-transmissible board [10] so as to be located above the photodetecting portion [15] of the image pickup element [11].